Appendix XIV.4-D

Waste Blending Station Process Description

APPENDIX XIV.4-D WASTE BLENDING STATION PROCESS DESCRIPTION

I. Description of Treatment Equipment

The waste blending station has been fabricated, except for the portable tank lid assembly, for installation in Area 514-1 as an interim status modification. This equipment will subsequently be transferred to the Building 695 Liquid Waste Processing (LWP) Area as an existing piece of equipment. The descriptions and requirements listed in this appendix are based on the specifications for the existing equipment. The equipment is not proposed to be modified when it is moved to the LWP area. All numerical values provided in this process description are approximate and represent normal operations. The equipment will be operated such that the design limits specified below will not be exceeded without prior DTSC approval.

Description	Design Limitation/Specification
Capacity, Mixing Vessel Maximum Operating	100 gallons, batch
Capacity, Diaphragm Pumps Maximum Operating	95 psig at 70˚F
Material of Construction Mixing Vessel Piping	 Fiberglass reinforced plastic, or equivalent 300 Series stainless steel, PVC, or equivalent

I.1 Purpose

The waste blending station will serve two primary purposes. The first is to combine smaller waste batches together in a controlled manner to obtain a homogeneous mixture for subsequent treatment. The second use is to thoroughly mix waste waters and chemical reagents together in a controlled process to support the treatment processes listed in **Table XIV.4-1.** The chemical reagents will be added either as part of the blending operation or to treat a single batch of waste.

I.2 Equipment Operations

Waste streams that are generated in small batches will typically be blended together to form larger batches for subsequent treatment. The blending will either be conducted in a skid mounted mixing vessel or in a portable tank. (NOTE: When used for blending operations, portable tanks are referred to as portable blending tanks.) Mixing devices; waste transfer pumps; and quick disconnects for process water, air, and chemical reagents will also be locally provided to support the blending operations. A process flow schematic for the waste blending station is provided as **Figure 1.**

A blending/treatment plan will be developed and documented each time blending is proposed. The characteristics of the waste batches are evaluated to determine the appropriate mixing sequence considering the following factors.

- Combining waste streams to allow beneficial reactions for treating each other (e.g., mixing low pH waste with high pH waste); and

- Preventing undesired reactions which are extremely exothermic, generate toxic gases that ~~can not~~ cannot be removed by the air pollution control equipment, or form hard-to-treat byproducts.

The mixing vessel has a capacity of approximately 100 gallons. The mixing vessel has a closed top with sealed inlets and outlets for transferring waste, adding chemical reagents, and venting. To allow blending in portable tanks, a lid assembly that attaches to the main hatch opening of the portable tank will be specially fabricated. The lid assembly will also have inlets and outlets that are functionally similar to the mixing vessel. The mixing vessel is typically used to blend waste streams that are less than 55 gallons; the portable blending tank will be used for larger volumes.

Two diaphragm and four metering pumps are fasten to the skid for transferring waste and making chemical reagent additions. The small diaphragm pump will be normally used to transfer the wastes from the feed containers to the mixing vessel using a sting tube assembly. Alternatively, the contents of small containers may be poured directly into the mixing vessel. After blending and/or chemical reagent additions, the large diaphragm pump can be used to transfer the waste to the tank farm, portable tank, waste container, or sanitary sewer via flexible hoses. Separated phases may also be skimmed or decanted from the mixing vessel or portable blending tank.

Chemical reagents may be added during the blending process. The waste blending station may also be used to treat a single large batch of waste when treatment in the tank farm does not provide adequate control of the chemical reaction. In these situations, the mixing vessel may be used to incrementally treat the waste in a semi-continuous flow process. The chemical feed system for the DWTF tank farm will be extended to the waste blending station to allow reagents to be pumped directly from the bulk storage chemical reagent tanks into the mixing vessel or portable blending tank. As shown ~~on~~ in **Figure 1,** separate feed lines and quick disconnects will be provided for each of the five chemical reagents (e.g., sodium hydroxide, sulfuric acid, hydrogen peroxide, ferric sulfate (flocculant), or a polyelectrolyte polymer) to facilitate the additions. The four metering pump circuits attached to the skid are fitted with pump bypasses and quick disconnects. Flexible hoses will be used to attain the desire transfer/feeding configuration between the DWTF chemical feed system and the waste blending station. The metering pump circuits will also be used to provide dedicated, local addition of chemical reagents, including those reagents listed in **Appendix XIV.4-R**.

The blending station has utility connections (e.g., electricity and air) to allow the local operation of pumps for transferring the wastes. A variable speed, top entering~~,~~ mixer is permanently mounted in the mixing vessel. Compressed air will normally be used to mix the contents of the portable blending tank. Pump recirculation may also be used as an alternate mixing method. To minimize the possibility of undesired reactions and to dissipate reaction heat, the contents will be

well mixed while other wastes or chemical reagents are slowly added in a controlled manner. The pH and temperature will be monitored during blending and mixing operations. Operators will take the appropriate corrective actions (e.g., terminating chemical reagent additions) if a sharp pH or temperature fluctuation is observed.

In order to comply with the requirements of 22 CCR 66264, Article 27 and 40 CFR 264, Subpart AA, off-gases and agitation air from the waste blending station will be vented to the GAS when required (e.g., organic concentration of the waste exceeds 10 ppm by weight). ~~In order to comply with the requirements of 22 CCR 66264, Article 27 and 40 CFR 264, Subpart CC, off-gases and agitation air from the waste blending station will be vented to the gas adsorption system when required (e.g., organic concentration of the waste exceeds 10 ppm by weight).~~ Both the mixing vessel and lid assembly will be operated under a slight negative pressure to prevent the uncontrolled release of airborne emissions and have quick disconnect ports to vent the off-gases to the gas adsorption system. The gas adsorption system consists of a scrubber, HEPA filter, and carbon adsorption columns. The treated exhaust from the gas adsorption system is vented to the Building 695 ventilation system for final HEPA filtering and monitoring prior to discharge to the atmosphere. Additional details regarding the design and operation of the air abatement equipment is provided in **Part XIV.4.3.3** and **Appendix XIV.4-K.**

I.3 Types of Hazardous Waste ~~to~~ To ~~be~~ Be Treated

The types of hazardous wastes to be managed in the waste blending station are listed in ~~the~~ **Part A and Table XIV.4-2.** The waste blending station will normally be used to blend and treat various hazardous waste including, but not limited to: acidic and caustic solutions; waste waters with dissolved and/or suspended solids; and other liquid wastes, sludges, and slurries that contain hazardous waste constituents.

II. Effectiveness of Treatment

II.1 Treatment Performance Information

The waste blending station and tank farm treatment processes are similar and are based on recognized methods for pH adjustment, flocculation, and oxidation/reduction reactions published in *Treatment of Metal Waste Streams* (USEPA, 1990). The effectiveness of treatment will be based on the ability of the process to adequately pre-treat hazardous and/or radioactive constituents (i.e., formation of precipitates) for subsequent treatment. It is expected that the blending process will be 100 percent effective for deactivating reactives, corrosives, and oxidizers. The blending processes in conjunction with the overall treatment train ~~is~~ are expected to reduce the weight of the waste waters by approximately 95 percent on average.

II.2 Process Controls

The waste blending station will have instruments, a programmable logic controller (PLC), and a control panel to monitor and/or adjust the items listed below. The waste blending station will normally be manually operated.

• Valve positions (e.g., open or closed) and diaphragm/metering pump operation (e.g., on or off) will be displayed on and controlled from the Building 695 PLC stations. The operation of the skid mounted metering pumps and valves will be interlocked with the chemical feed system for the DWTF tank farm to ensure that waste and chemical reagents are not blended in an unsafe manner (e.g., simultaneous additions of incompatible materials).

• Flow measurement will be taken from the large waste pump and will be used to verify how much waste is being added to the portable blending containers. For waste being fed into the blending tank, a level indicator is used to determine how much waste has been pumped into the tank and therefore a flow measurement is not needed as it would be redundant.

• Actual amounts of reagents expected to be required for a treatment will not be included on a blending plan because these values are not known. Waste streams are significantly different from one to another and it is much safer to rely on the endpoint characteristics of a treatment (e.g., pH, temperature, ORP) than it is to rely on how much reagent has been added. A treatment should not be stopped and deemed complete if a predetermined amount of reagent has been added. A treatment should be deemed complete when the endpoint has been reached based on various properties (e.g., pH).~~Flow rate and total flow readings will be obtained for both the waste feed and chemical reagents. These measurements will be used for waste tracking and record keeping and to verify that the proper amount of chemical reagents were added as specified in the blending/treatment plan.~~

• The mixing vessel and portable blending tank lid assembly are equipped with a combined pH and temperature probe. The probe is mounted on the end of a stainless-steel tube that is secured to either the top of the mixing vessel or lid assembly by a compression fitting to allow the tube and probe to be completely withdrawn for calibration, storage, and maintenance. The waste blending station PLC will be used to continuously monitor the pH and temperature of the blending solution. The measurements can be recorded and archived for later data analysis. ~~If the pH reading rises above 12.5 or drops below 2 or if the temperature increases by more than 20°C when blending or feeding chemical reagents, the PLC automatically shuts off the appropriate pump(s) and activates a warning alarm.~~ Operators will take the appropriate corrective actions (e.g., terminating chemical reagent additions) if a sharp pH or temperature fluctuation is observed. (~~NOTE: The PLC interlocks are manually overridden during the initial charging of the mixing vessel or portable tank if the pH of temperature of the waste are not within the pre-established set-points. Once the waste batch has been stabilized/neutralized, automatic control is returned to the PLC.)~~

• A high fluid level indicator will also be mounted on the mixing vessel and lid assembly. At the high level set point, the warning alarm is activated by the PLC to alert the operator. If filling continues to the high-high level set point, then the PLC automatically shuts off the pump(s) to prevent overflow.

• An air flow indicator switch is mounted in the air discharge plenum of the waste blending station. The system is interlocked to prevent operation of the waste blending station if no air flow is detected in the plenum (e.g., gas adsorption system is not operating).

• ~~The control panel will have a timer which will be used to verify that the process mixing duration are in accordance with the blending/treatment plan.~~

II.3 Inspections and Maintenance

Operators will be properly trained prior to being allowed to operate the waste blending station unsupervised. A pre-operational safety inspection will be conducted each day that the blending station is to be used. At a minimum, the following items will be visually inspected:

• General condition of the blending station (e.g., loose fittings or bolts, frayed wires, flexible hoses, worn valve diaphragms, clear access, etc.);

• Proper function of instruments, alarms, interlocks, and emergency shut-off controls; and

• Operation of the gas adsorption system (see **Appendix XIV.4-K**).

III. Equipment Specifications

The mixing vessel, mounts and connections for local waste and chemical reagent feeding reside on a skid-mounted platform with fork-lift pockets to allow the system to be moved within the miscellaneous unit boundary. **Figure 2** provides a schematic cross-sectional view of the skid. A photograph of the waste blending station is included as **Exhibit 1.** The platform is approximately 6 feet by 8 feet with a maximum height around 7 feet. All blending station hardware (~~expect~~ except for the lid assembly) and local controls are located on the skid. Electric power, process water, and air supplies will be from the Building 695 utility systems. The skid anchoring and other structural supports are seismically designed.

III.1 Mixing Vessel

The mixing vessel is approximately 33 inches in diameter and 30 inches tall (not including the bottom cone) with a nominal operating capacity of 100 gallons. The mixing vessel has an 8 inch high conical bottom and a closed top. The mixing vessel is supported off the ground on a stand that is secured to the skid. Fiberglass-reinforced plastic (e.g., vinyl ester resin with ultraviolet inhibitors) was selected as the material of construction since it is compatible with both the wastes and the reagent solutions expected to be treated.

The mixing vessel top has ports for adding waste and chemical reagents, venting gaseous emissions to the gas adsorption system, inserting a pH/temperature probe and liquid level switch to monitor the blending process, and installing the mixer. Four chemical reagents and one waste feed inlet~~s~~ are provided. The chemical and waste feed lines are fabricated from 1/2-in. diameter tubing and discharge at a level just above the highest liquid surface level in the mixing vessel to provide an air break to prevent siphoning or backflow. The control valves tubes are securely fastened to a stiffening bracket that is attached above the mixing vessel top. The blended waste is removed through a 2-in. diameter pipe at the conical bottom. The feed and transfer lines have quick disconnects. Flexible hoses will be used to make the final connections between the quick disconnect to attain the desire transfer/feeding configuration.

III.2 Pumps

Six pumps are attached to the waste blending skid. Two diaphragm pumps will be used for waste transfers and four metering pumps will handle chemical reagent additions. The small waste pump will be used to transfer waste into the mixing vessel or the portable blending tank depending upon the position of the discharge valves. The pump is a pneumatically-operated, positive-displacement, double-diaphragm pump with 1/2-in. diameter inlet and outlet ports and ball-type check valves. The capacity of the pump can be varied from 0 to 14 gpm. The nominal operating pressure of the pump is 95 psig.

The large waste pump will be used to transfer large quantities of waste into a portable blending tank or to transfer blended waste from the mixing vessel or portable blending tank into a receiving waste container, portable tank, or tank farm. The pump is a pneumatically-operated, positive-displacement, double-diaphragm pump with 2-in. diameter inlet and outlet ports and flapper-type check valves. The nominal operating capacity of the pump is 135 gpm at an air pressure of 95 psig.

Both the small and large diaphragm pumps are equipped with a muffler on the air discharge port, a surge suppresser on the discharge side for leveling pressure fluctuations, and an air regulator for adequate air flow distribution as needed. A strainer, sized to remove particulates of 1/4-in. diameter or larger, is installed on the suction side of the pumps. Quick disconnects are provided to connect air lines to the pumps. The primary construction materials used for the wetted parts are stainless steel, polypropylene, Hytrel, TFE, and PVDF since these materials are resistant to the corrosive properties of the wastes to be handled.

Four metering pumps are also attached to the waste blending station skid to provide dedicated, local addition of various chemical reagents. The metering pumps are similar to those that will be installed for the tank farm chemical feed system. The specifications of the metering pumps are described in **Part XIV.4.6.1.**

III.3 Piping and Valves

The blending station was built with a 1" PVC waste transfer line for the small diaphragm pump instead of using 1/2 inch diameter, Series 300 stainless-steel tubing and fittings. The chemical reagent feed lines ~~and waste transfer line for the small diaphragm pump~~ are hard-plumbed on the blending skid using 1/2-in. diameter, Series 300 stainless-steel tubing and fittings. The waste transfer line for the small diaphragm pump is fabricated from 1-in. diameter CPVC. The waste transfer line for the large diaphragm pump is fabricated from 2-in. diameter, Series 300 stainless steel pipe. ~~Series 300 stainless steel was selected because of its compatibility with the wastes and chemical reagents, availability, and durability.~~ The valves for these lines are all air-actuated ball valves and will be controlled from the DWTF PLC stations.

Stainless-steel, 1/2-in.-diameter, braided hoses will be used for the flexible chemical reagent and small diaphragm pump connections. Reinforced, 2-in. diameter, flexible polyvinyl chloride (PVC) hoses will be used to complete the large diaphragm pumping circuit. These flexible hoses have good general chemical resistance for the wide range of characteristics expected to be

encountered. These hoses can also be easily examined for wear and damage caused by corrosion. Worn and damage hoses will be repaired or replaced as required.

III.4 Portable Blending Tank Lid Assembly

The portable tanks used at LLNL range in size from 600 to 1,150 gallons with main hatch openings of varying diameters ranging from approximately 18 to 24 inches. **Figure 3** provides a schematic view of the lid assembly that will be fabricated to fit on these openings. The lid assembly is designed with a series of inlets and outlets for transferring waste, adding chemical reagents, and venting. All inlets and outlets on the lid assembly will be made from rigid pipe compatible with all fluids. The four chemical reagent inlet lines will be fabricated from 1/2-inch diameter Series 300 stainless steel tubing and discharge at a level just above the highest liquid surface in the tank to prevent any siphoning or backflow problems. The waste inlet will be made from 2-in.-diameter, stainless-steel pipe which is compatible with all anticipated wastes. The lid assembly will also house a pH and temperature probe in a perforated sheath. An air line, attached to the bottom drain of the portable blending tank, will be used to provide the necessary agitation for mixing.

IV. Equipment Drawings

Drawing AAA 94-100132-00 (Sheets 1 to 7) ~~are~~ is included for information only to provide reviewers a more detailed visual depiction of the waste blending station. The actual equipment installed within the Building 695 S/TUG may deviate from the dimensions, capacities, notes, and other information presented on these drawings. These deviations do not compromise the performance controls established for the waste blending station or cause the LWP miscellaneous unit treatment area to violate regulatory requirements.

Figure 1. Process Flow Schematic of the Waste Blending Station

Figure 2. Cross-Sectional View of the Waste Blending Station Skid

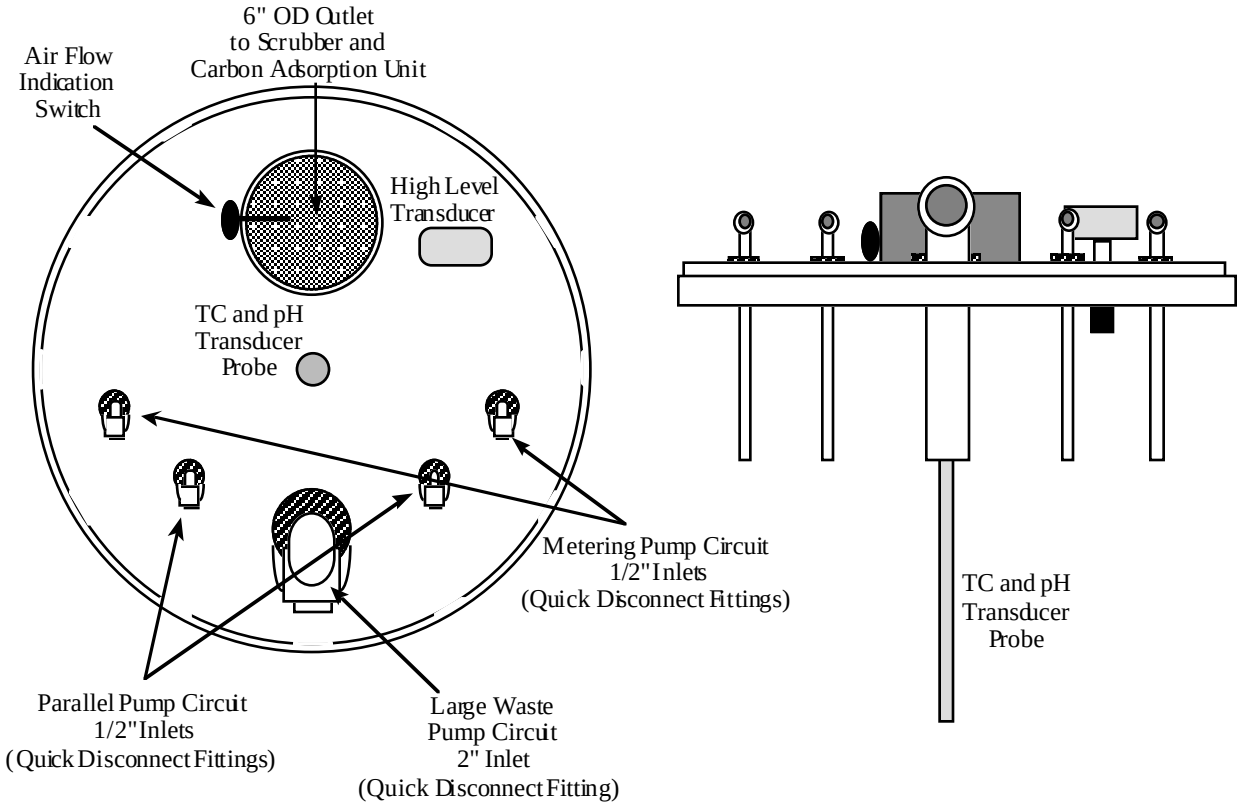

Figure 3. Schematic Detail of the Portable Blending Tank Lid Assembly

Exhibit 1. Photograph of the Waste Blending Station Skid

Waste Blending Station Drawings.

Click on the title to see the drawing

Portable Blending Unit Pumping Station – Sheet 1

Portable Blending Unit Pumping Station – Sheet 2

Portable Blending Unit Pumping Station – Sheet 3

Portable Blending Unit Pumping Station – Sheet 4

Portable Blending Unit Pumping Station – Sheet 5

Portable Blending Unit Pumping Station – Sheet 6

Portable Blending Unit Pumping Station – Sheet 7